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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re International Application of

International Serial No. PCT/JP99/06055
International filing date: 29 October 1999
For: Non-Aqueous Electrolyte Battery and Manufacturing Method Therefor

VERIFICATION OF TRANSLATION

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231
Sir:

Kouchi Takasaki, a member of A.KOIKE & CO., of 11-Mori Bldg., 6-4, Toranomon 2-chome, Minato-ku, Tokyo 105-0001, Japan, declares:

(1) that he knows well both the Japanese and English languages;

(2) that he translated the above-identified International Application from Japanese to English;

(3) that the attached English translation is a true and correct translation of the above-identified International application to the best of his knowledge and belief; and

(4) that all statements made of his own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements are made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under 18USC 1001, and that such false statements may jeopardize the validity of the application or any patent issuing thereon.

20th June 2000
Date

Kouchi Takasaki
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09/582752

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT :
APPLICATION No. :
FILING DATE :
TITLE :

Group Art Unit :
Examiner :

Hon. Commissioner of Patents and Trademarks,
Washington, D.C. 20231

SIR:

CERTIFIED TRANSLATION

I, Mio Hashimoto, am an official translator of the Japanese language into the English language and I hereby certify that the attached comprises an accurate translation into English of Japanese Application No. 10-311482, filed on October 30, 1998.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

May 16, 2000
Date

Mio Hashimoto
Mio Hashimoto

Patent Office

Japanese Government

This is to certify that the annexed is a true copy of the following application as filed with this Office.

Date of Application: October 30, 1998

Application Number: Patent Application

Ser. No. 10-311482

Applicant: Sony Corporation

August 20, 1999

Commissioner,

Patent Office Takeshi Isayama

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[Title of the Invention]	Non-Aqueous Electrolyte Battery
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[Indication of Charge]

[Number of Prepaid Ledger]	019530	
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[NAME OF DOCUMENT] SPECIFICATION

[TITLE OF THE INVENTION]

NON-AQUEOUS ELECTROLYTE BATTERY

[SCOPE OF CLAIM FOR PATENT]

[Claim 1] A nonaqueous electrolyte battery comprising:

a case constituted by a laminate film and accommodating a unit cell enclosed by heat-sealing; and

electrode terminal leads electrically connected to electrodes which constitute said unit cell and sandwiched in a heat-sealed portion so as to be exposed to the outside, wherein

said electrode terminal leads are coated with a coating layer structured by laminating a plurality of layered resins which have individual melting points which are different from one another by 20°C or greater.

[Claim 2] A nonaqueous electrolyte battery according to claim 1, wherein said coating layer incorporates a layered resin which is sandwiched between layered resins each having a low melting point, said layered resin forming the sandwiched layer having a melting point higher than that of the resin having the low melting point by 20°C or greater.

[Claim 3] A nonaqueous electrolyte battery according to claim 1, wherein said layered resin having the low melting point is constituted by polyolefin, said layered resin having the melting point higher than the low melting point by 20°C or greater is

constituted by at least one material selected from a nylon resin, a polyimide resin, a polyester resin and an aromatic polyamide resin.

[Claim 4] A nonaqueous electrolyte battery according to claim 1, wherein said layered resin having the melting point which is different from the low melting point by 20°C or greater is constituted by olefin polymers having different monomer unit ratios.

[Claim 5] A nonaqueous electrolyte battery according to claim 1, wherein the length for which said coating layer is allowed to flow over said case is larger than the thickness of said case.

[Claim 6] A nonaqueous electrolyte battery according to claim 1, wherein the thickness of said coating layer is 10 μm to 500 μm.

[Claim 7] A nonaqueous electrolyte battery according to claim 1, wherein electrolyte constituting said unit cell is made of a gel electrolyte or a solid electrolyte containing a matrix polymer and lithium salt.

[Claim 8] A nonaqueous electrolyte battery according to claim 1, wherein a negative electrode constituting said battery cell contains a material which permits doping/dedoping of lithium.

[Claim 9] A nonaqueous electrolyte battery according to claim 8, wherein said material which permits doping/dedoping of lithium is a carbon material.

[Claim 10] A nonaqueous electrolyte battery according to claim 1, wherein a positive electrode constituting said unit cell contains a composite oxide of lithium and transition metal.

[DETAILED DESCRIPTION OF THE INVENTION]

[0001]

[TECHNICAL FIELD OF THE INVENTION]

The present invention relates to a nonaqueous electrolyte battery incorporating a case constituted by a laminate film and accommodating a battery device, and more particularly to an improvement in the portions in each of which an electrode terminal lead and the case are welded to each other with heat.

[0002]

[PRIOR ART]

In recent years, a multiplicity of portable electronic apparatuses, such as camcoders, portable telephones and portable computers have made their appearance in recent years. The size and weight of the electronic apparatuses have been required to be reduced. As a portable power source for the above-mentioned electronic apparatuses, research and development of batteries, secondary batteries and nonaqueous electrolyte secondary batteries (so-called lithium-ion batteries) have energetically been performed to realize a thin and foldable structure.

[0003]

Research and development of solidified electrolytic solution have energetically been performed to serve as the electrolyte of the above-mentioned shape-variable battery. In particular, a gel electrolyte which is a solid electrolyte containing a plasticizer and a polymer-type solid electrolyte having a structure that lithium salt is

dissolved in polymers have received attention.

[0004]

To use the merit of the foregoing battery that the thin and light weight structure can be realized, a variety of batteries have been studied which are structured such that a plastic film or a so-called laminate film obtained by bonding a plastic film and a metal member is used to seal the battery device. One of important requirements of the foregoing battery is to realize reliability of hermetic sealing as well as or better than that of the metal can.

[0005]

[PROBLEMS TO BE SOLVED BY THE INVENTION]

In a case of a battery of a type incorporating the case constituted by an aluminum laminate pack, elongated electrode terminals are allowed to extend over the heat-sealed surface of the case.

[0006]

In the foregoing case, there arises a problem of fluidization of a resin present on the end surface of the metal foil of the case extending over the end surface of an outlet opening. Fluidization of the resin also occurs when heat-sealing has been performed under conditions deviated from an appropriate temperature range or an appropriate pressure range. It leads to a fact that the surface of the exposed metal foil and the electrode terminal are undesirably brought into contact with each other. Thus, short circuit occurs.

[0007]

Accordingly, an object of the present invention is to develop a package having a structure in which a resin which is highly resistant to heat and pressure is disposed to cover terminals extracted from the package so as prevent occurrence of short circuit.

[0008]

[MEANS FOR SOLVING THE PROBLEMS]

To achieve the above-mentioned object, according to one aspect of the present invention, there is provided a nonaqueous electrolyte battery comprising: a case constituted by a laminate film and accommodating a unit cell enclosed by heat-sealing; and electrode terminal leads electrically connected to electrodes which constitute said unit cell and sandwiched in a heat-sealed portion so as to be exposed to the outside, wherein said electrode terminal leads are coated with a coating layer structured by laminating a plurality of layered resins which have individual melting points which are different from one another by 20°C or greater.

[0009]

As a result of energetic studies, a fact has been found that short circuit occurs at the end surface of a portion of the case from which the terminal is extracted and surfaces of the terminal and the case which have been heat-sealed to each other. The short circuit of a type occurring at the interface between the terminal and the case can be prevented by inserting a heat-sealing resin capable of joining terminal and the case

to each other into the interface. The short circuit of a type occurring at the end surface can be prevented by a structure in which a resin is allowed to flow over the interface of the heat-sealed surfaces to cover the surfaces of the terminals extending over the interface. When a heat-sealing operation is performed at a temperature and a pressure excessively higher than the required temperature and the pressure, the foregoing resin is fused. In the foregoing case, short circuit occurs at the interface between the terminal and the case. In the foregoing case, the resin on the outer surface is fused at a somewhat higher temperature or a resin which cannot easily be fluidized is placed in the resin structure such that the resin is formed into a layer structure. Thus, occurrence of the short circuit can be prevented.

[0010]

[EMBODIMENT OF THE INVENTION]

The structure of a nonaqueous electrolyte battery according to the present invention will now be described with reference to the drawings.

[0011]

The nonaqueous electrolyte battery according to the present invention is, for example, a solid-electrolyte battery or a gel electrolyte battery. As shown in Figs. 1 and 2, a unit cell 1 has a structure that a solid electrolyte or a gel electrolyte is sandwiched between a positive-electrode active material layer and a negative-electrode active material layer. The unit cell 1 is accommodated in a case 2 constituted by a laminate film. Then, the peripheral portion of the laminate film is welded with heat

so that the unit cell 1 is sealed in the case 2.

[0012]

The unit cell 1 incorporates a negative-electrode terminal lead 3, which is electrically connected to a negative electrode which constitutes the unit cell 1, and a positive-electrode terminal lead 4 which is electrically connected to a positive electrode. The negative-electrode terminal lead 3 and the positive-electrode terminal lead 4 are taken to the outside of the case 2.

[0013]

The nonaqueous electrolyte battery according to the present invention has the structure that the negative-electrode terminal lead 3 and the positive-electrode terminal lead 4 are sandwiched by the heat weld portion of the case 2 so as to be exposed to the outside of the case 2 when the unit cell 1 is sealed in the case 2. At least portions of the negative-electrode terminal lead 3 and the positive-electrode terminal lead 4 sandwiched by the laminate film and welded with heat are coated with coating layer. Thus, resistance against penetration of moisture can be maintained and satisfactory adhesive properties with the terminal metal and sufficient adhesive properties with the innermost layer of the laminate film can be obtained.

[0014]

The foregoing structure is shown in Fig. 3. The case 2 is constituted by, for example, three layers consisting of a case protecting layer 21, an aluminum layer 22 and a heat weld layer (the innermost layer of the laminate film) 23. When the outer

periphery of the case 2 is welded with heat, sealing is performed. Therefore, the periphery of the case 2 is formed into a heat weld portion 2a having a predetermined width. Thus, the heat weld layers 23 in the foregoing portion are welded to each other with heat.

[0015]

As a result, the negative-electrode terminal lead 3 and the positive-electrode terminal lead 4 traverse the heat weld portion 2a so as to be taken to the outside of the case 2.

[0016]

In the present invention, the portions of the negative-electrode terminal lead 3 and the positive-electrode terminal lead 4 corresponding to the heat weld portion 2a are coated with coating layer 6.

[0017]

Fig. 4 shows a coating structure for the negative-electrode terminal lead 3 which is taken as an example. The negative-electrode terminal lead 3 is first coated with a undercoat layer 5 (which may be omitted). Then, the outer surface of the negative-electrode terminal lead 3 is coated with the coating layer 6.

[0018]

When the heat welding process is performed, the surface portion of the coating layer 6 must be melted. Moreover, the resin materials which must be combined with each other are required not to be melted and fluidized in any case. The heat fusible

resin may be polyethylene or polypropylene. The resin materials which must be combined may be polyethylene terephthalate, Teflon, aramide resin or polyimide. As an alternative to employment of different materials, resin for example, polypropylene, may be employed such that a copolymer having a low melting point is employed in the heat weld portion. Thus, the surface and the lower layer may be different from each other. In the foregoing case, control of the molecular weight, copolymerization ratio and the molecular structure enables the lower layer to have a high melting viscosity when the melting points are not different from each other. Thus, the shape stability of the resin can be obtained. In the foregoing cases, another advantage can be obtained in that an integrated structure can easily be formed by performing simultaneous extrusion or multilayer coating when the bonding structure is not employed.

[0019]

A material having a melting point which is higher than that of the material of the surface layer by 20°C is employed to form the central layer of the resin with which the electrode terminal leads is coated. Moreover, the resin with which the terminal is coated is caused to protrude over the end surface of the heat weld portion. Thus, a battery with which short circuit between terminals can be provided.

[0020]

The quantity of protrusion of the coating layer 6 over the case 2 will now be described. In consideration of prevention of short circuit caused from the contact with

the thin metal film (the aluminum layer 22) constituting the case 2, it is preferable that the length of the protrusion of the coating layer 6 over the case 2 is longer than the thickness of the case 2. The quantity of protrusion is not limited. When the apparatus is structured such that, for example, the connection with an external circuit is established at the end surface of the terminal lead, the overall surface of the terminal lead may be covered with the coating layer 6. To easily establish the connection, it is preferable that the terminal lead is exposed to the outside by 0.5 mm or longer.

[0021]

It is preferable that the thickness of the coating layer 6 is 10 μm to 500 μm. When the thickness of the coating layer 6 is too small, a required object cannot sufficiently be obtained. When the thickness is too large, a stepped portion is undesirably formed to perform satisfactory heat welding.

[0022]

The coating layer 6 may have an arbitrary structure. Although Fig. 3 shows the example in which the coating layer 6 is formed on each of the terminal leads, a plurality of terminal leads may collectively be coated with the coating layer 6 as shown in Fig. 5.

[0023]

The coating layer 6 may be formed into one film which is wound around the electrode terminal lead. As an alternative to this, two films may be formed so as to sandwich the electrode terminal lead.

[0024]

A case will now be considered such that the unit cell 1 is the solid electrolyte battery or the gel electrolyte battery. In the foregoing case, a polymer material for use as the polymer solid electrolyte may be any one of the following materials: silicon gel, acrylic gel, acrylonitrile gel, polyphosphagen denatured polymer, polyethylene oxide, polypropylene oxide, their composite polymers, crosslinked polymers, denatured polymers; fluorine polymers, such as poly (vinylidene fluororide), poly (vinylidene fluororide-co-hexafluoropropylene), poly (vinylidene fluororide-co-tetrafluoroethylene), poly (vinylidene fluororide-co-trifluoroethylene) and their mixture. As a matter of course, the present invention is not limited to the foregoing materials.

[0025]

The solid electrolyte or the gel electrolyte laminated on the positive-electrode active material layer or the negative-electrode active material layer is prepared by causing the positive-electrode active material layer or the negative-electrode active material layer to be impregnated with solution composed of a polymer compound, electrolyte salt and solvent (moreover, a plasticizer in a case of the gel electrolyte). Then, the solvent is removed, and then the solution is solidified. A portion of the solid electrolyte or the gel electrolyte laminated on the positive-electrode active material layer or the negative-electrode active material layer is a portion with which the positive-electrode active material layer or the negative-electrode active material layer

is impregnated. Then, the foregoing portion is solidified. In a case of the crosslinked system, light or heat is then applied to perform crosslinking so that the portion of the foregoing electrolyte is solidified.

[0026]

The gel electrolyte is composed of a plasticizer containing lithium salt and 2 wt% to 30 wt% matrix polymer. At this time, ester, ether or carbonate may be employed solely or as a component of the plasticizer.

[0027]

As the matrix polymer for gelling the carbonate when the gel electrolyte is prepared, any one of a variety of polymers for use to constitute the gel electrolyte may be employed. From a viewpoint of realizing stability of oxidation and reduction, it is preferable that a fluorine polymer may be employed which is, for example, poly (vinylidene fluororide) or poly (vinylidene fluororide-co-hexafluoropropylene).

[0028]

The polymer solid electrolyte is composed of lithium salt and a polymer compound for dissolving the lithium salt. The polymer compound may be an ether polymer, such as poly (ethylene oxide), its crosslinked material or poly (methacrylate) ester or acrylate, a fluorine polymer, such as poly (vinylidene fluororide), poly (vinylidene fluororide-co-hexafluoropropylene). The foregoing material may be employed solely or their mixture may be employed. From a viewpoint of realizing stability of oxidation and reduction, it is preferable that a fluorine polymer may be

employed which is, for example, poly (vinylidene fluororide) or poly (vinylidene fluororide-co-hexafluoropropylene).

[0029]

The lithium slat which is contained in the gel electrolyte or the polymer solid electrolyte may be usual lithium salt which is used in electrolytic solution for a battery. The lithium compound (salt) may be any one of the following materials. Note that the present invention is not limited to the following materials.

[0030]

The lithium compound is exemplified by lithium chloride, lithium bromide, lithium iodide, lithium chlorate, lithium perchlorate, lithium bromate, lithium iodate, lithium nitrate, tetrafluorolithium borate, lithium hexafluorophosphate, lithium acetate, bis (trifluoromethanesulfonyl) imide lithium, $LiAsF_6$, $LiCF_3SO_3$, $LiC (SO_2CF_3)_3$, $LiAlCl_4$ and $LiSiF_6$.

[0031]

The lithium compound may be employed solely or a mixture of the foregoing lithium compounds may be employed. From a viewpoint of stability of oxidation, it is preferable that $LiPF_6$ or $LiBF_4$ is employed.

[0032]

The concentration of the lithium salt which must be dissolved in a case of the gel electrolyte may be 0.1 mole to 3.0 moles in the plasticizer. It is preferable that the concentration is 0.5 mol/litter to 2.0 mole/litter.

[0033]

The battery according to the present invention can be structured similarly to the conventional lithium-ion battery except for use of the gel electrolyte or the solid electrolyte.

[0034]

That is, the material of the negative electrode for constituting the lithium-ion battery may be a material which permits doping/dedoping of lithium. The material for constituting the negative electrode may be a carbon material, such as non-graphitizable carbon material or graphite material. Specifically, pyrocarbon, cokes (pitch cokes, needle cokes or petroleum cokes), graphite, vitreous carbon, a material obtained by baking an organic polymer (a material obtained by baking phenol resin or furan resin at an appropriate temperature), carbon fibers or active carbon. Another material which permits doping/dedoping of lithium may be a polymer, such as polyacetylene or polypyrrole or an oxide, such as SnO_2. When the negative electrode is manufactured from the foregoing material, a known binder or the like may be added.

[0035]

The positive electrode may be structured by using a metal oxide, a metal sulfide or a specific polymer as the positive-electrode active material to meet the requirement of the battery. When the lithium-ion battery is structured, the positive-electrode active material may be a metal sulfide or an oxide, such as TiS_2, MoS_2, $NbSe_2$ or V_2O_5 which does not contain lithium. As an alternative to this, a lithium composite oxide mainly

composed of Li_xMo_2 (where M is one or more types of transition metal materials, x varies according to a state of charge/discharge and x is usually not smaller than 0.05 or larger than 1.10). It is preferable that the transition metal M which constitutes the lithium composite oxide is Co, Ni or Mn. The lithium composite oxide is exemplified by $LiCoO_2$, $LiNiO_2$, $LiNi_yCo_{1-y}O_2$ (where $0 < y < 1$) and $LiMn_2O_4$. The lithium composite oxide is an excellent positive-electrode active material which is capable of generating high voltage and realizing excellent energy density. A plurality of the foregoing positive-electrode active materials may be employed in the positive electrode. When the positive electrode is manufactured by using the above-mentioned positive-electrode active material, a known conductor and a binder may be added.

[0036]

The structure of the unit cell 1 may be a laminate structure constituted by alternately laminating the positive electrode and the negative electrode such that the solid electrolyte is sandwiched; a wound structure constituted by laminating the positive electrode and the negative electrode such that the solid electrolyte is sandwiched and by winding the laminate; and a folded structure constituted by laminating the positive electrode and the negative electrode such that the solid electrolyte is sandwiched and by alternately folding the laminate. Any one of the foregoing structures may arbitrarily be employed.

[0037]

The present invention may be applied to both of the primary battery and the

secondary battery. When the present invention is applied to a nonaqueous electrolyte secondary battery, a satisfactory effect can be obtained.

[0038]

[Examples]

Examples and comparative examples of the present invention will now be described such that results of experiments are described.

[0039]

A sample battery was manufactured and evaluated as follows.

[0040]

A laminate sheet having size 7 cm × 14 cm and incorporating the heat weld resin which was non-oriented polypropylene having a thickness of 70 μm was folded back in the lengthwise direction such that the non-oriented polypropylene was positioned inwards. To form a 4 cm × 4 cm sealing portion, the electrode terminals were taken from the interface of the heat welded portion of the laminate film to the outside. The heat welding resin (the coating layer) was wound around a portion in which the terminal and the heat weld portion overlapped. Thus, the laminate sheet having a thickness of 100 μm, the terminal and the resin were simultaneously welded with heat.

[0041]

At this time, the terminal was coated with an adhesive agent to bond the coating layer. The sealing conditions were such that the temperature of the heater was set to

make the temperature of the interface of the heat weld portion to be higher than the melting point by 10°C. The heaters disposed on the two sides were operated for 5 seconds. The pressure was 4 kgf/cm^2 which was higher than the pressure set when a usual sealing process was performed. The cut portion of the pack was sandwiched between the heaters. The occurrence of short circuit was determined as follows: a portion of the resin on the laminate sheet was separated to expose the metal film. Then, whether or not electrical conduction between the terminal and the metal film occurred was determined.

[0042]

To evaluate the sealing performance, an electrolytic solution was injected into the container. The container was preserved at 70°C and 90 % RH. Thus, the quantity of enlargement of the moisture content was measured in ten days.

[0043]

The structure of the coating layer of each examples and comparative examples was as follows.

[0044]

Example 1

Coating layer had right and reverse sides each of which was constituted by bonding polyethylene having a melting point of 120°C and an intermediate layer which was constituted by polyethylene terephthalate having a melting point of 260°C. The coating layer having a thickness of 10 μm was protruded over the case by 100 μm.

[0045]

Example 2

Coating layer had right and reverse sides each of which was constituted by bonding propylene having a melting point of 160°C and an intermediate layer which was constituted by polyimide having a melting point of 700°C. The coating layer having a thickness of 10 μm was protruded over the case by 100 μm.

[0046]

Example 3

Coating layer had right and reverse sides each of which was constituted by bonding propylene having a melting point of 120°C and an intermediate layer which was constituted by polyimide having a melting point of 700°C. The coating layer having a thickness of 10 μm was protruded over the case by 100 μm.

[0047]

Example 4

Coating layer had right and reverse sides each of which was constituted by bonding copolymer polypropylene having a melting point of 140°C and an intermediate layer which was constituted by single-polymer polyethylene having a melting point of 162°C. The coating layer having a thickness of 10 μm was protruded over the case by 100 μm.

[0048]

Example 5

The thickness of the resin of Example 1 was 500 μm.

[0049]

Comparative Example 1

Coating layer had right and reverse sides each of which was constituted by bonding copolymer polyethylene having a melting point of 100°C and an intermediate layer which was constituted by single-polymer polyethylene having a melting point of 114°C. The coating layer having a thickness of 10 μm was protruded over the case by 100 μm.

[0050]

Comparative Example 2

The thickness of the resin of Comparative Example 1 was 8 μm.

Comparative Example 3

The thickness of the resin of Comparative Example 1 was 600 μm.

Comparative Example 4

The resin of Comparative Example 1 was protruded by 80 μm.

Occurrence of short circuit of each test battery was shown in Table 1. The quantity the moisture content which had penetrated into each of Example 1 and Comparative Example 3 was shown in Table 2.

[0051]

Table 1

	Occurrence of Short Circuit
Example 1	not occurred
Example 2	not occurred
Example 3	not occurred
Example 4	not occurred
Example 5	not occurred
Comparative Example 1	occurred
Comparative Example 2	occurred
Comparative Example 3	not occurred
Comparative Example 4	occurred

[0052]

Table 2

	Quantity of Penetration of Moisture Content (ppm)
Example 1	100
Comparative Example 3	600

[0053]

In a case of Comparative Example 1 in which the difference in the melting point is small, also the resin having the higher melting point is softened and fluidized when the sealing process is performed. Thus, the coating is broken.

[0054]

In a case of Comparative Example 2 in which the resin has a small thickness of 8 μm, the resin coating is broken when the sealing process is performed. Therefore, it is preferable that the thickness of the coating layer is 10 μm or larger.

[0055]

In a case of Comparative Example 3 in which the resin has a large thickness, occurrence of short circuit can effectively be prevented. However, the heat welding process using flat heaters suffers from unsatisfactory sealing performance. Therefore, the moisture content in an excessively large quantity was introduced in the measurement of the quantity of penetration of the moisture content, the result of which is shown in Table 2. When the moisture content in a quantity not smaller than 300 ppm is introduced into the battery, the battery deteriorates excessively. Therefore, it is preferable that the thickness of the coating layer is 500 μm or smaller.

[0056]

In a case of Comparative Example 4 in which the protrusion of the coating layer is small such that the protrusion is shorter than the thickness of the case, the metal film at the cut portion of the case is brought into direct contact with the terminal. Thus, short circuit occurs.

[0057]

On the other hand, the test batteries in Example 1 to Example 5 were free from occurrence of the short circuit and considerable penetration of the moisture content.

[0058]

[EFFECT OF THE INVENTION]

As described above, according to the present invention, the nonaqueous electrolyte battery having the structure capable of preventing occurrence of the short circuit can be provided.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1]

Fig. 1 is an exploded perspective view showing an example of the structure of a nonaqueous electrolyte battery according to the present invention;

[Fig. 2]

Fig. 2 is an exploded perspective view showing an example of the structure of the nonaqueous electrolyte battery according to the present invention;

[Fig. 3]

Fig. 3 is a schematic perspective view including a partially broken portion and showing a heat-sealed portion of a case;

[Fig. 4]

Fig. 4 is a schematic cross sectional view showing an example of the structure of a coating layer for a negative-terminal lead; and

[Fig. 5]

Fig. 5 is a schematic perspective view including a partially broken portion and showing another example of the coating layer.

[DESCRIPTION OF THE REFERENCE NUMERALS]

1 unit cell

2 case

3 negative-electrode terminal lead

4 positive-electrode terminal lead

5 undercoat layer

6 coating layer

[NAME OF DOCUMENT] ABSTRACT

[ABSTRACT]

[TASK]

It is an object to provide a nonaqueous electrolyte battery having the structure capable of preventing occurrence of the short circuit can be provided.

[MEANS FOR SOLUTION]

A nonaqueous electrolyte battery incorporating a case constituted by a laminate film and accommodating a unit cell enclosed by heat-sealing; and electrode terminal leads electrically connected to electrodes which constitute the unit cell and sandwiched in a heat-sealed portion so as to be exposed to the outside, wherein the electrode terminal leads are coated with a coating layer structured by laminating a plurality of layered resins which have individual melting points which are different from one another by 20°C or greater, and the length for which the coating layer is allowed to flow over the case is larger than the thickness of the case.

[SELECTED DRAWING] Fig. 3

[Document Name]	Official Correction Data
[Corrected Document]	Patent Application

<Authorized Information · Additional Information>

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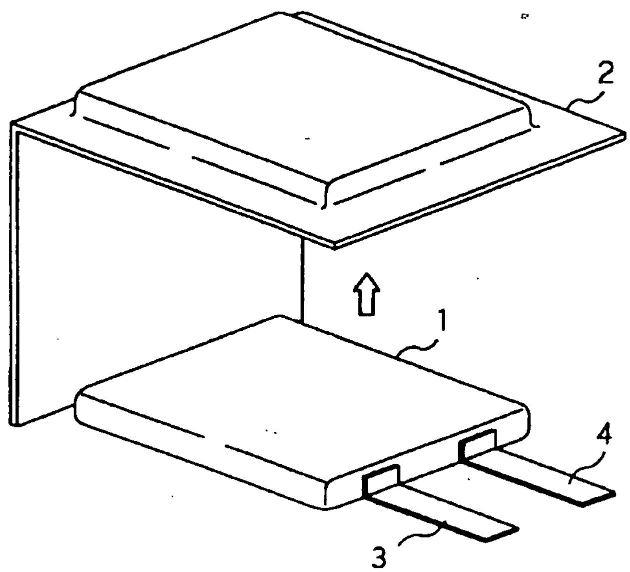
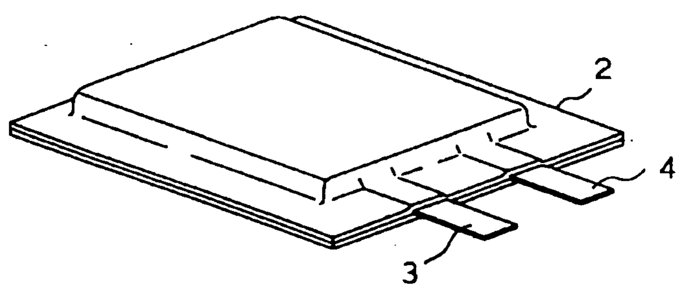
[DOCUMENT NAME] DRAWING

[FIG. 1]



[FIG. 2]



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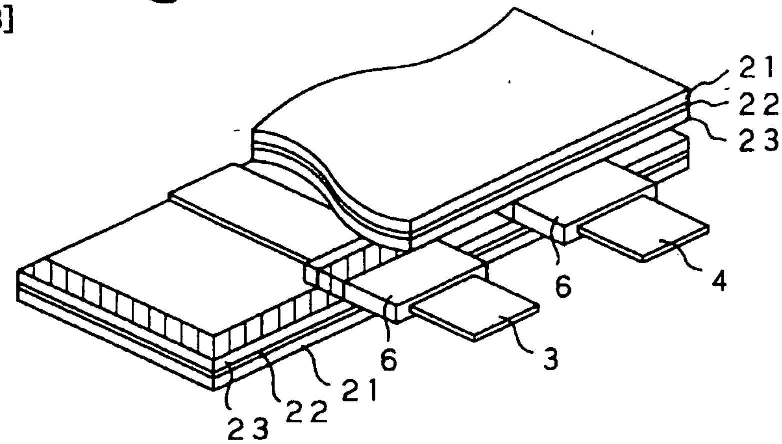
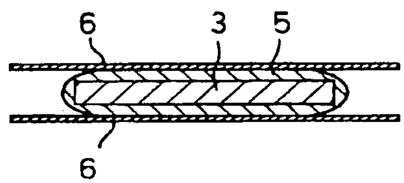
[FIG. 3]



[FIG. 4]



[FIG. 5]